SECTION 227

Beachsaver Reef

Double-T Sill

An Evaluation of Performance Measures for Prefabricated Submerged Concrete Breakwaters:

Section 227 Cape May Point, New Jersey Demonstration Project

2.5 Year Results

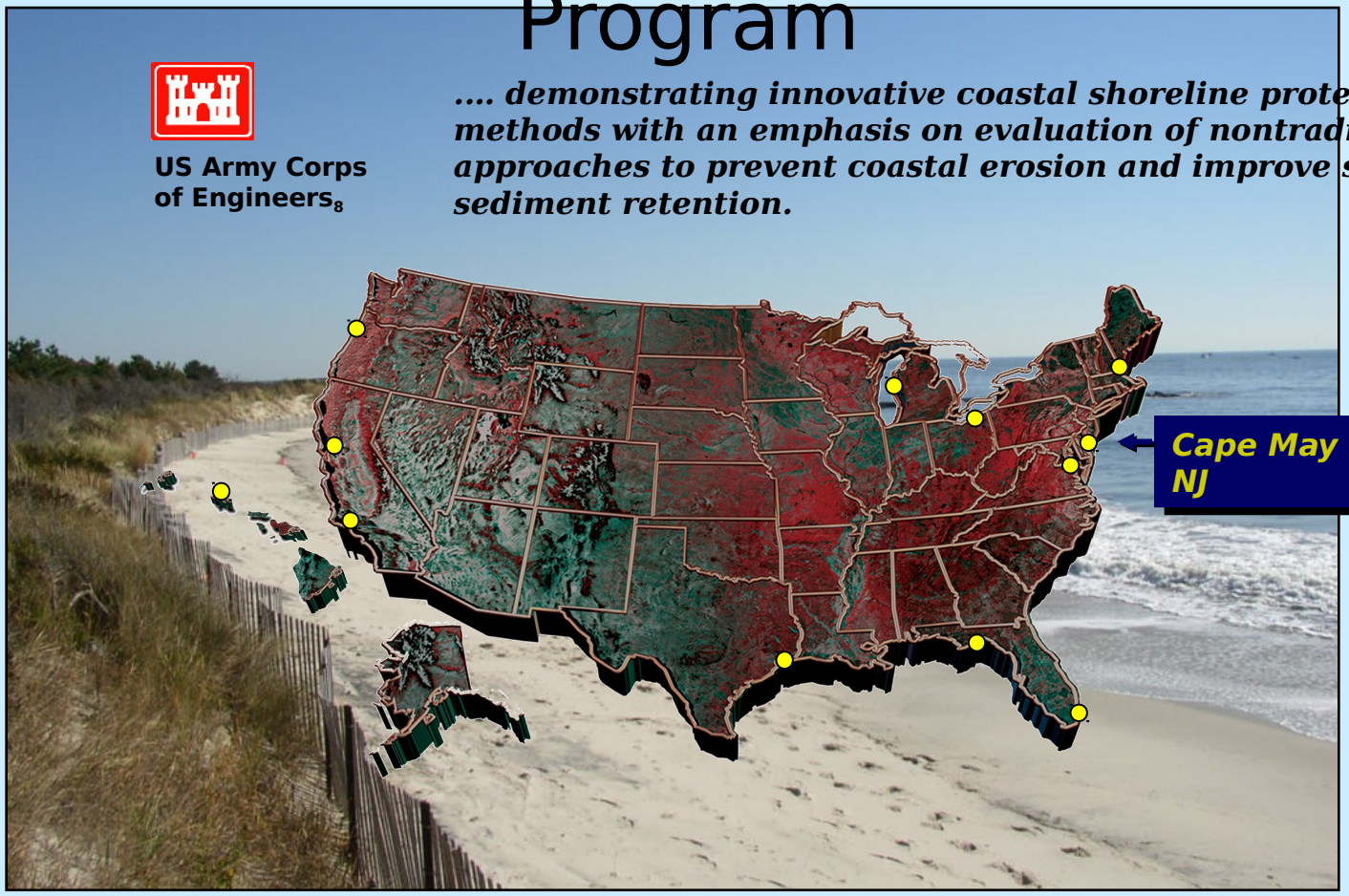
Donald K Stauble - Engineer Research & Development Center,
Coastal and Hydraulics Laboratory
J.B. Smith - Philadelphia District
Randall A. Wise - Philadelphia District

US Army Corps of Engineers

National Shoreline Erosion Control Demonstration and Development Program

US Army Corps of Engineers[8]

.... demonstrating innovative coastal shoreline protection methods with an emphasis on evaluation of nontraditional approaches to prevent coastal erosion and improve shoreline sediment retention.



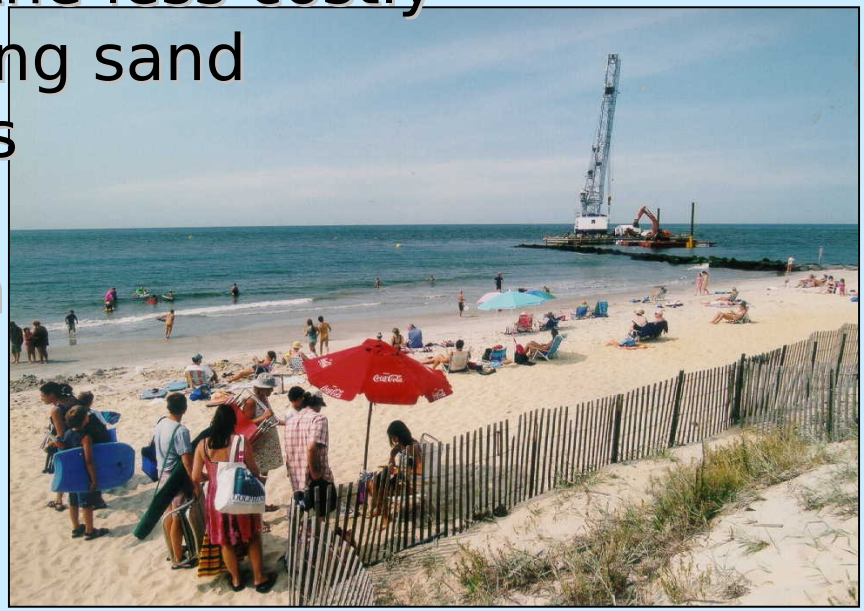
OBJECTIVES

SECTION 227

1) To evaluate the effectiveness of the two submerged structures in retaining sand on the beach as compared with unprotected groin compartments

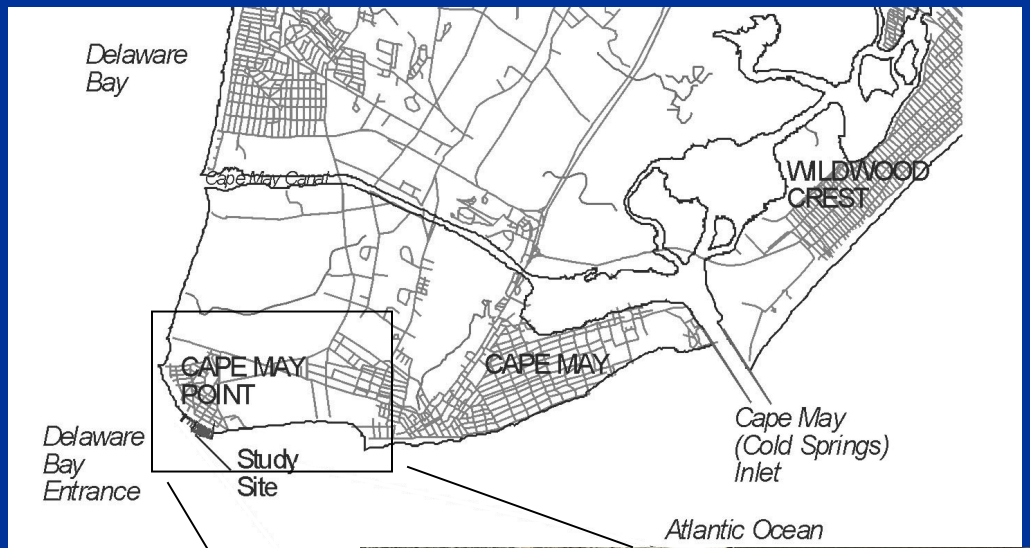
2) Compare the effectiveness of the more costly *Beachsaver Reef* with the less costly *Double-T Sill* in retaining sand in groin compartments

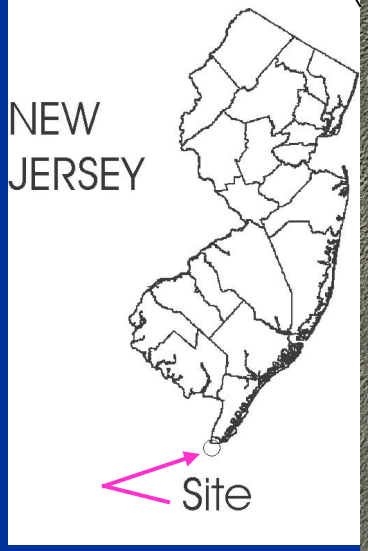
3) Evaluate ability of both structures to retain Beach Fill material after placement



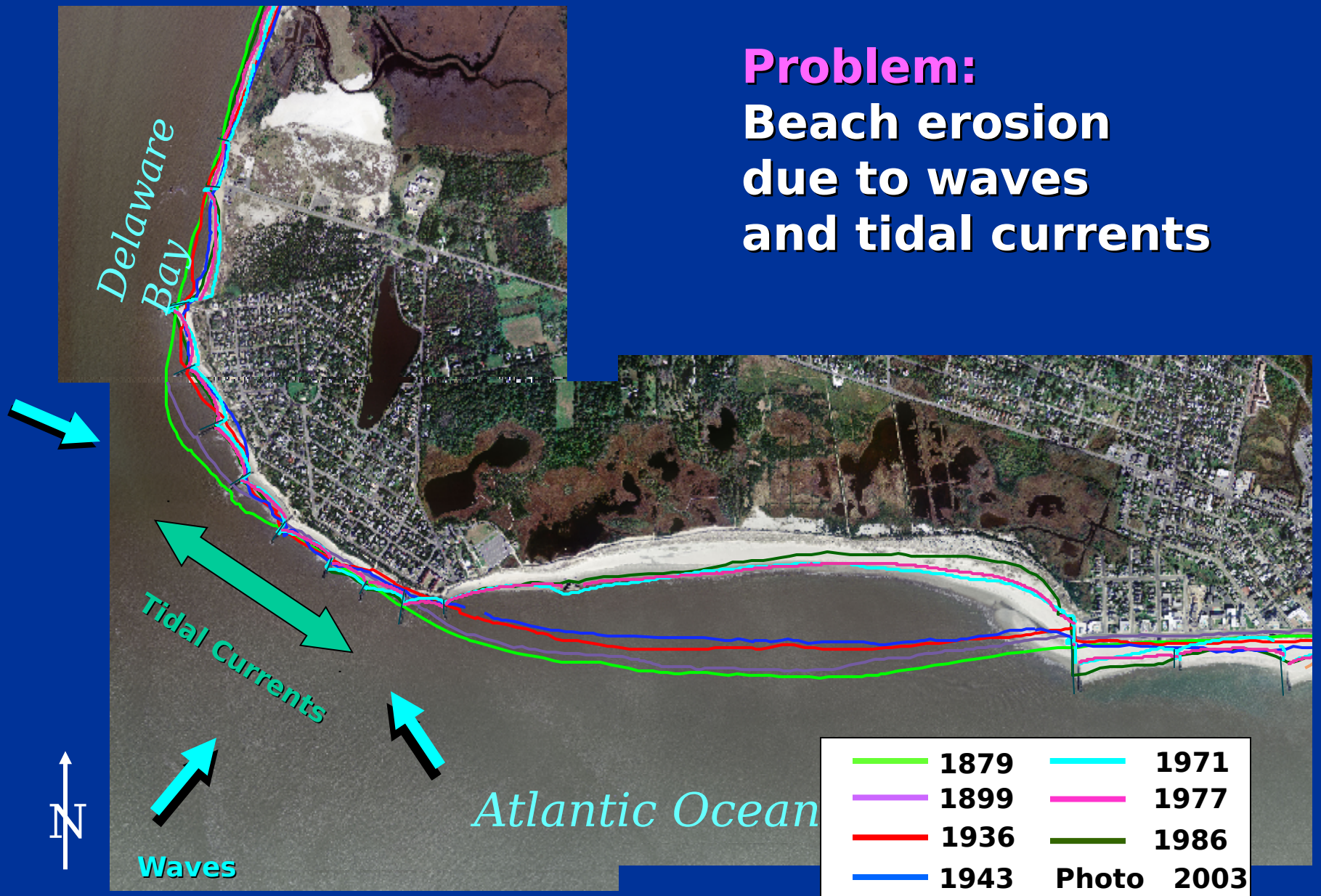
SITE LOCATION

CAPE MAY POINT is southern most beach in New Jersey at entrance to Delaware Bay



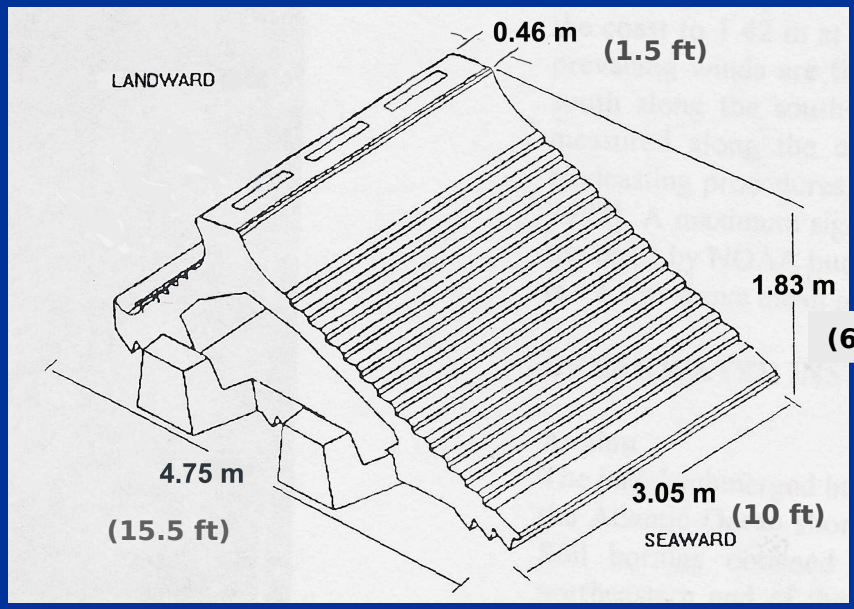


HISTORICAL SHORELINE CHANGE



Problem:
Beach erosion due to waves and tidal currents

BEACHSAVER REEF

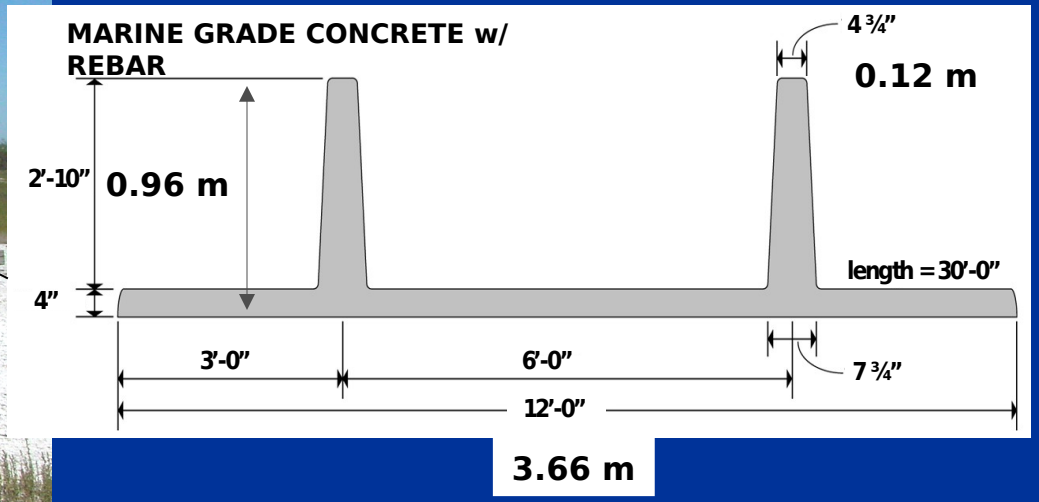


Placed in ~ -9 ft NAVD of water
~ -2.7 m NAVD
Top of reef just below water line at Low w

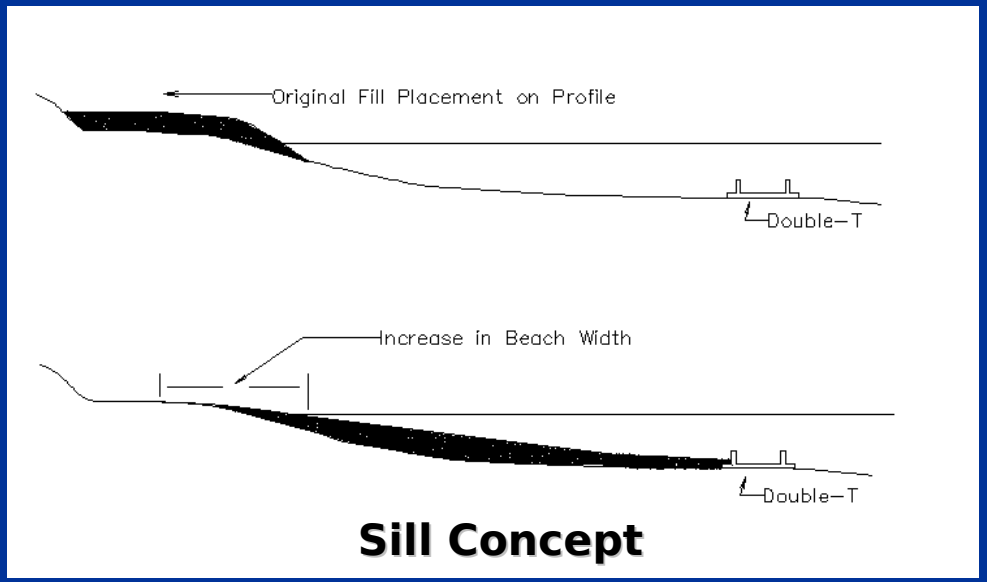
Three reef units placed over each filter fabric scour prevention layer

DOUBLE – T SILL

Units placed on sand (no filter cloth)
At ~ -9 ft NAVD w/ crest at –6 ft at low wa
At ~ -2.7 m NAVD w/crest at –1.8 m at low

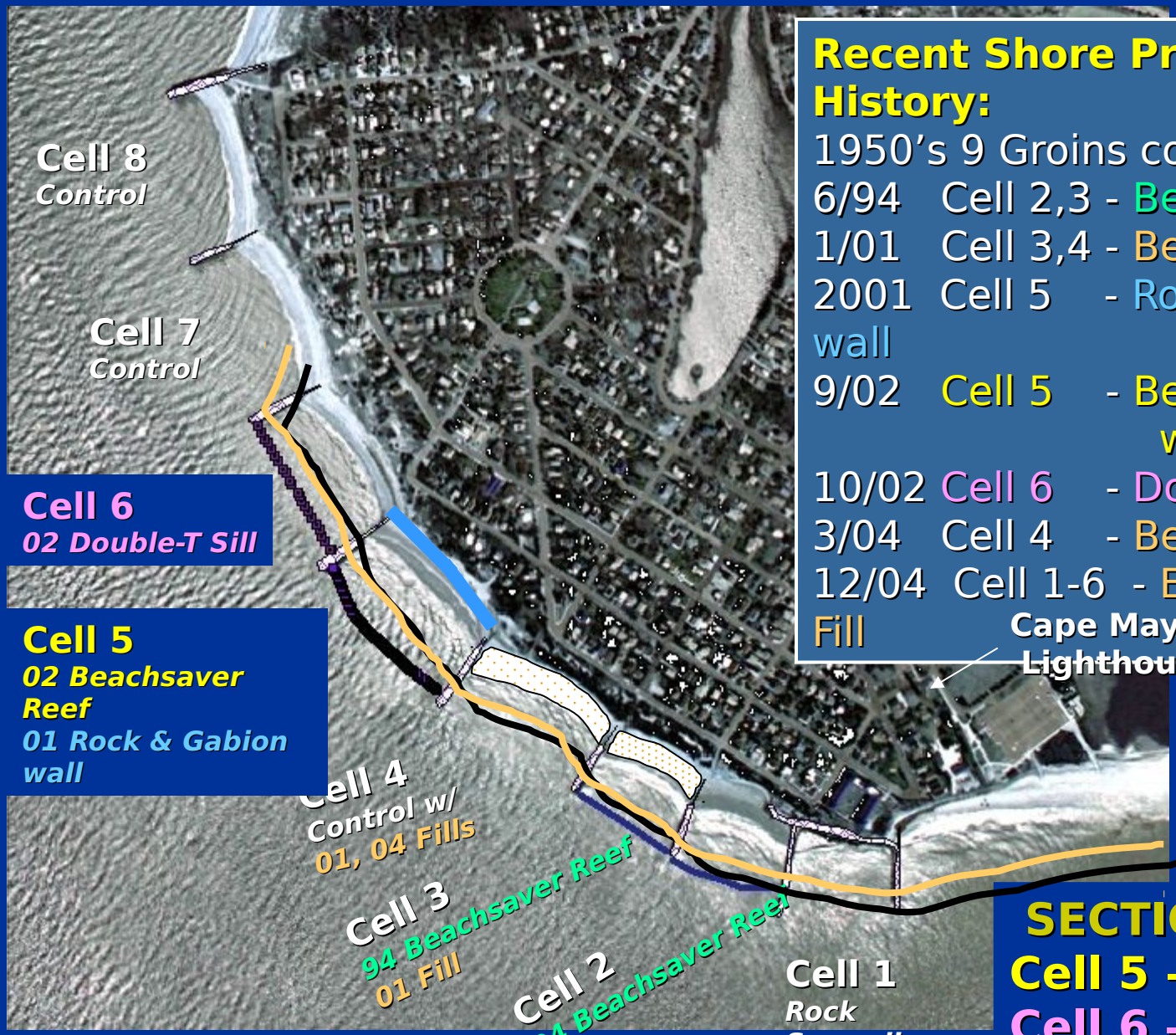


Interlocking End



Sill Concept

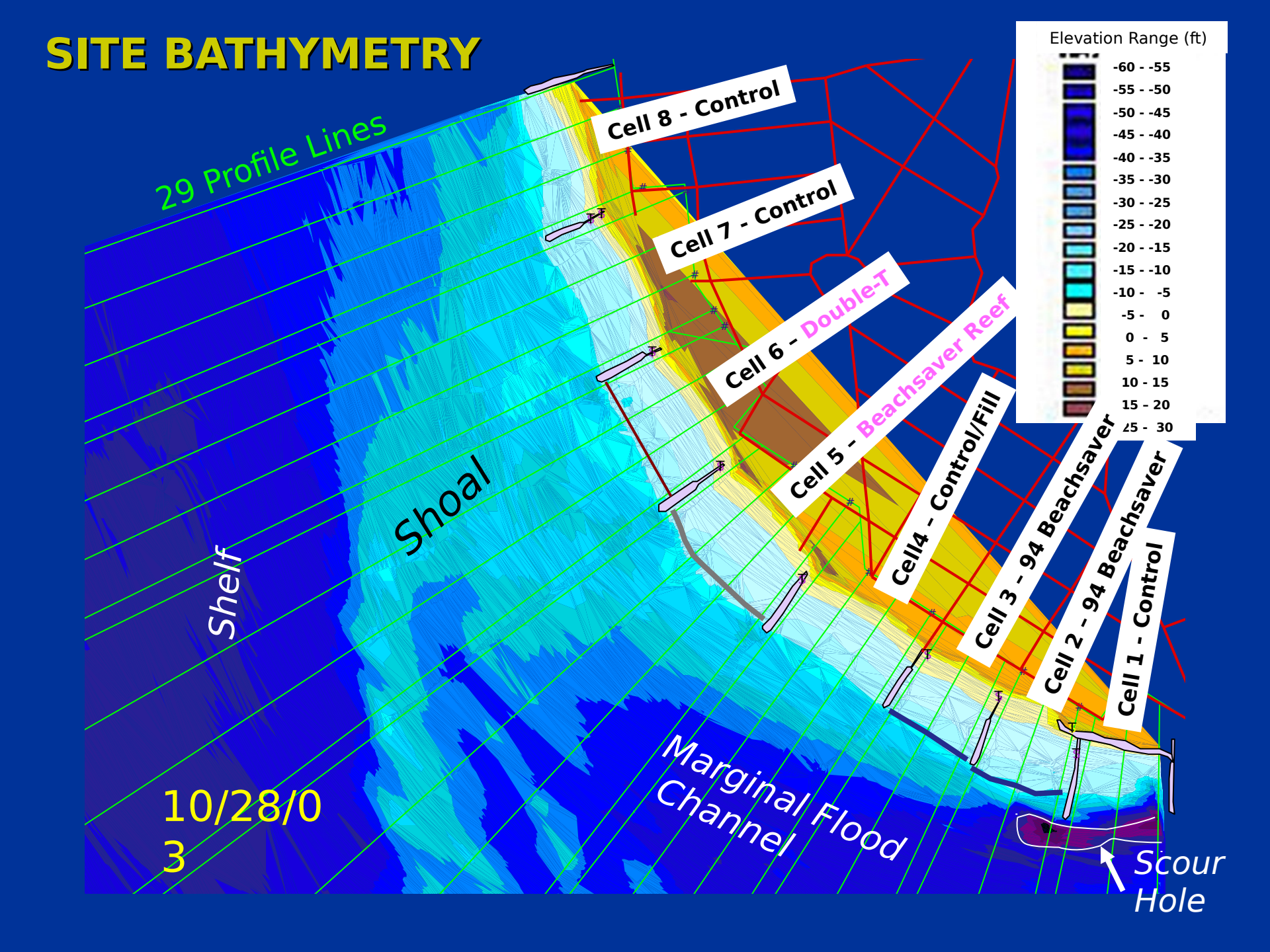
CAPE MAY POINT SITE LAYOUT



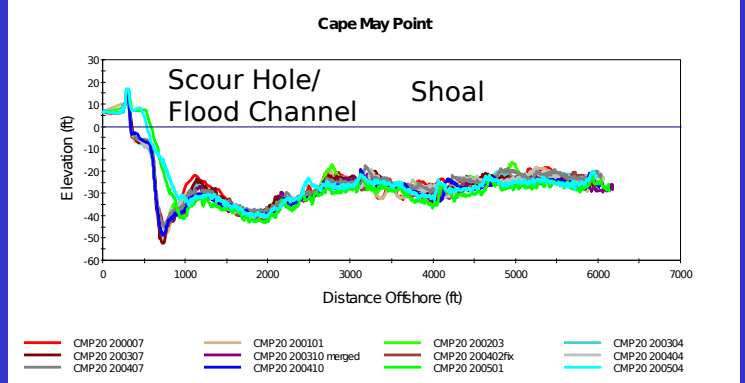
Recent Shore Protection History:

1950's 9 Groins constructed
6/94 Cell 2,3 - Beachsaver Reef
1/01 Cell 3,4 - Beach fill
2001 Cell 5 - Rock & Gabion wall
9/02 Cell 5 - Beachsaver Reef w/ filter
10/02 Cell 6 - Double-T Sill
3/04 Cell 4 - Beach Fill
12/04 Cell 1-6 - Eco Sys Res Bch Fill

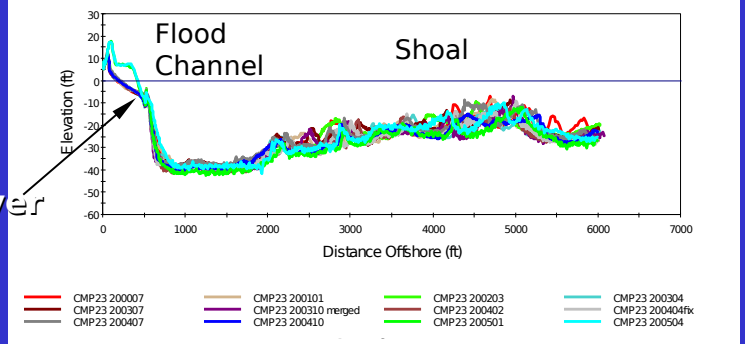
SECTION 227 PROJECT
Cell 5 – Beachsaver Re
Cell 6 – Double-T Sill


SITE BATHYMETRY
29 Profile Lines
Cell 8 - Control
Cell 7 - Control
Cell 6 - Double-T
Cell 5 - Beachsaver Reef
Cell4 - Control/Fill
Cell 3 - 94 Beachsaver
Cell 2 - 94 Beachsaver
Cell 1 - Control
Elevation Range (ft)
-60 - -55
-55 - -50
-50 - -45
-45 - -40
-40 - -35
-35 - -30
-30 - -25
-25 - -20
-20 - -15
-15 - -10
-10 - -5
-5 - 0
0 - 5
5 - 10
10 - 15
15 - 20
25 - 30
Shelf
Shoal
Marginal Flood Channel
Scour Hole
10/28/03

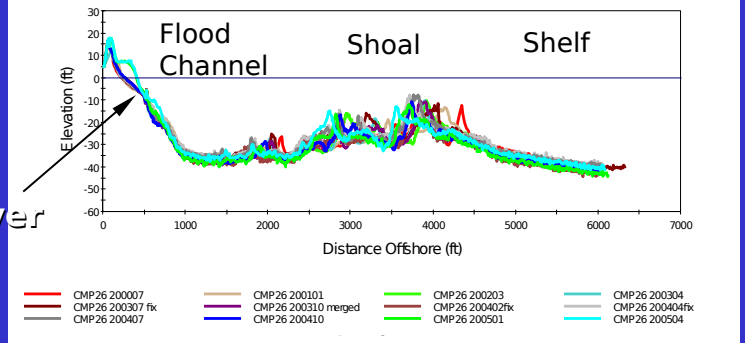
Cell 1
Control



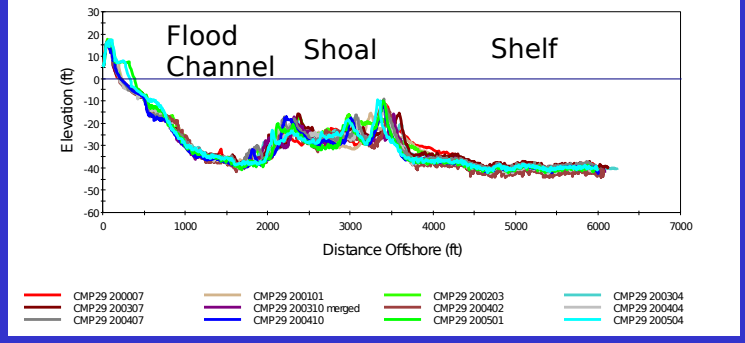
Cell 2
1994
Beachsaver



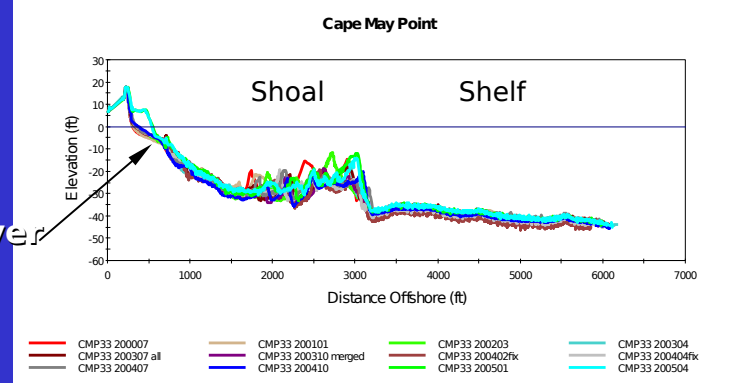
Cell 3
1994
Beachsaver



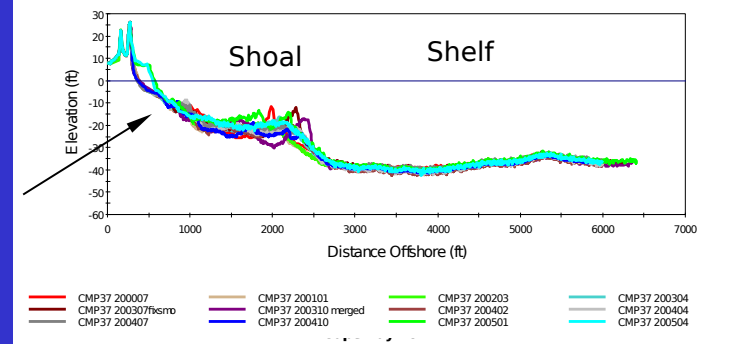
Cell 4
Control



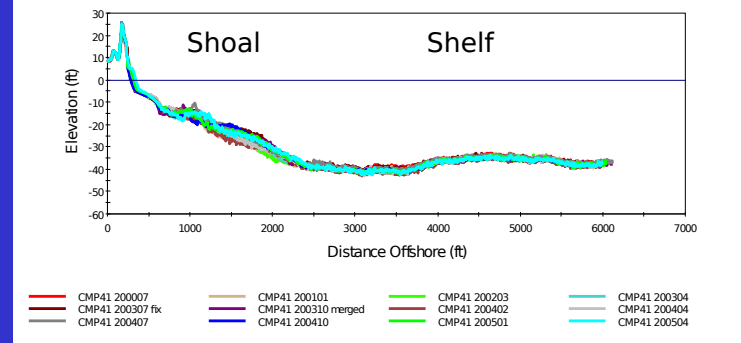
Cell 5
227
Beachsaver



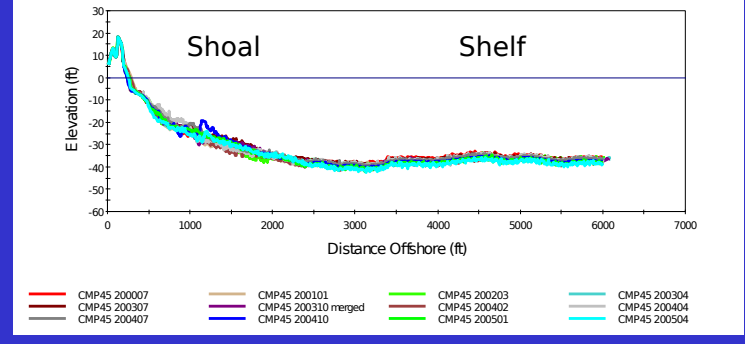
Cell 6
227
Double-T



Cell 7
Control



Cell 8
Control



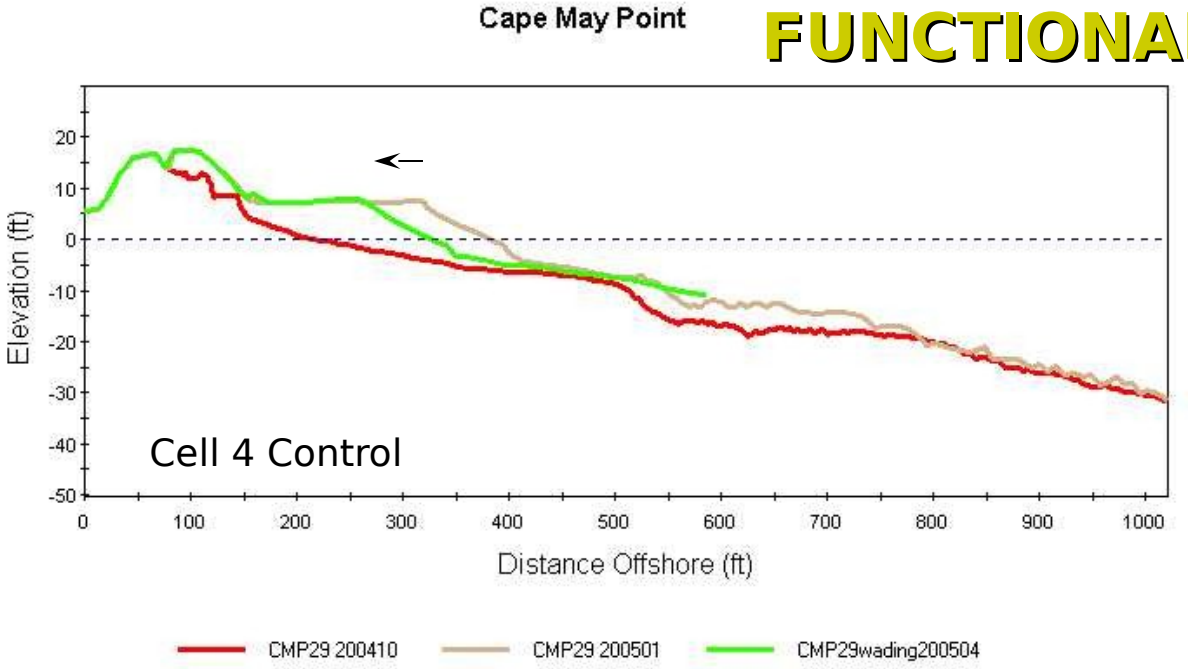
MONITORING PROJECT PERFORMANCE

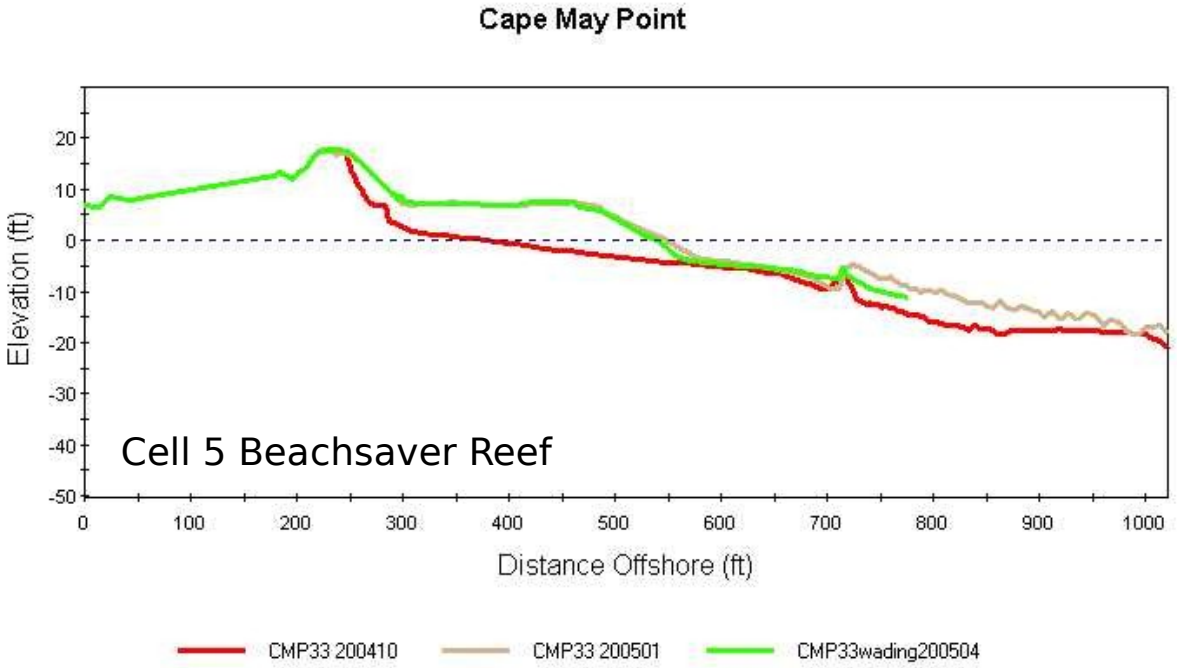
SECTION 227

- **Functional Performance**
  - Sand Retention
    - Volume Change
    - Change in MHW Shoreline Position
- **Economic Performance**
  - Reduction in Renourishment Quantities & Lengthening Fill Cycle
    - Improve Protection
    - Reduce Uncertainty
    - Reduce Costs
- **Structural Performance**
  - Structural Stability
    - Change in Structure Crest Elevation
    - Alongshore Integrity
    - Depth of Scour

FUNCTIONAL PERFORMANCE

Volume Change

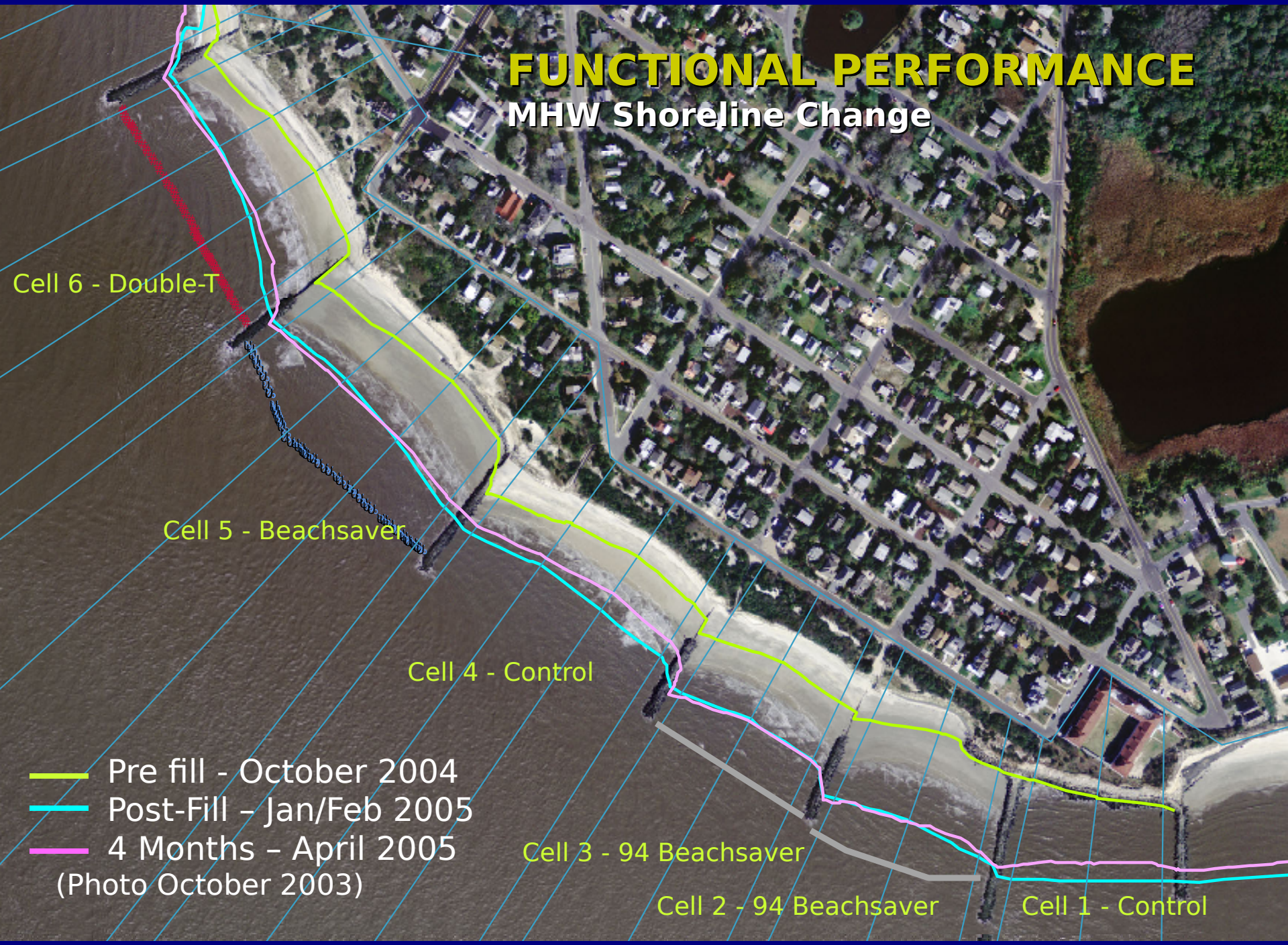




Pre -Fill

Post -Fill

4 Months


FUNCTIONAL PERFORMANCE
MHW Shoreline Change
Cell 6 - Double-T
Cell 5 - Beachsaver
Cell 4 - Control
Pre fill - October 2004
Post-Fill – Jan/Feb 2005
4 Months – April 2005
(Photo October 2003)
Cell 3 - 94 Beachsaver
Cell 2 - 94 Beachsaver
Cell 1 - Control

ECONOMIC PERFORMANCE – Construction Costs

SECTION 227

Beachsaver Reef – 16 Aug to 25 Sep 02

- 5 weeks @cost of $1,440/lf

  72 10-ft-long units covering 720 ft
  - Filter cloth installation
  - Excavation and fill required
  - Placement of units w/ diver

Double-T Sill – 26 Sep to 2 Oct 02

- 4 days @ cost of $345/lf

  22 30-ft-long units covering 660 ft
  - NO Filter cloth installation
  - Excavation and fill NOT required
  - Placement of units w/ diver

(Cost of rock used in both cells to tie into groin tips not included in linear foot cost)

ECONOMIC PERFORMANCE -

SECTION 227

Reduction in Renourishment Quantities & Lengthening Fill Cycle (Economic Performance/Life Cycle Cost Analysis)

Structures designed to act as a sill to retain sand within the groin comp

Lower Cape May Meadows/Cape May Point Eco System Restoration Proj constructed December 2004 will document fill retention and extension renourishment cycle time in cells with and without structures

Purpose: Relate engineering performance to economic costs

Goal: Evaluate improved performance (benefits) in relation to investment (cost

Based on present monitoring
Anticipated savings in:

- **Initial fill retention**
- **Longer renourishment intervals**

in cells with Beachsaver Reefs

BEACH FILL Performance –

Cape May Point to Cape May Meadows Eco-System Restoration Project

Placed Cell 1-6 - December 2004
To Protect Coastal Wetland

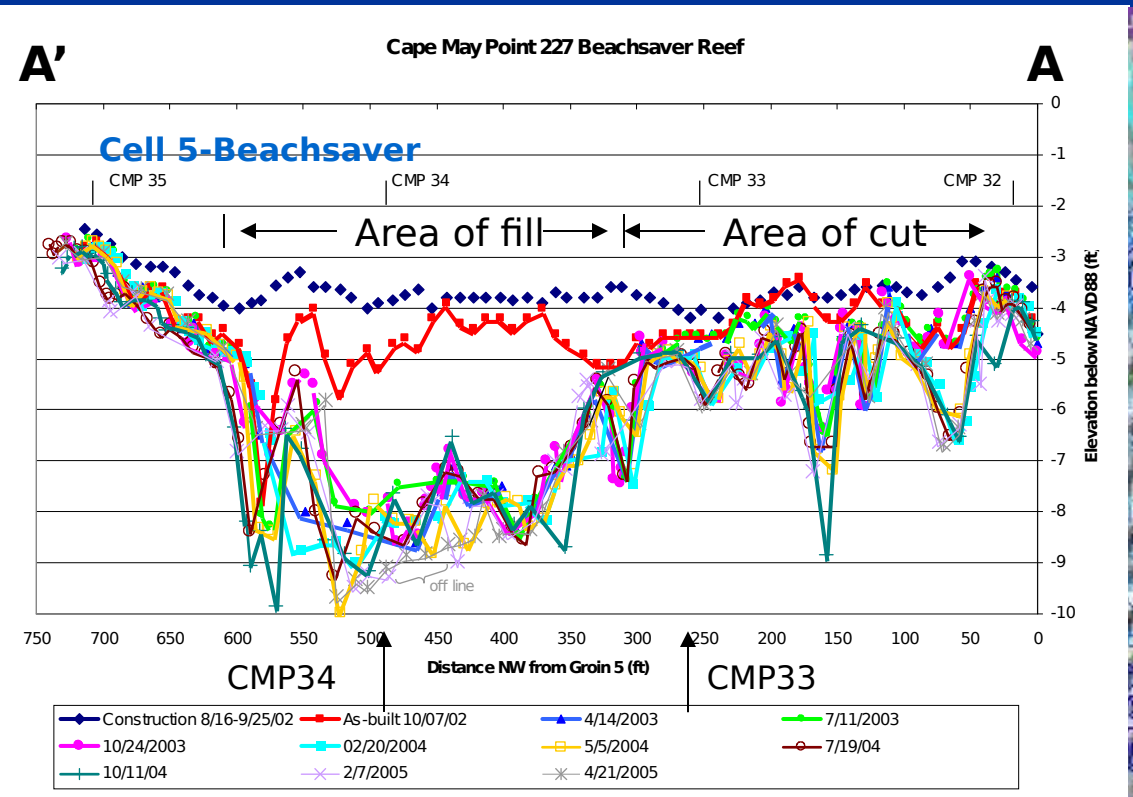
Post-fill: +7 ft to –42 ft shoreline gain/ret
100% to 79% volume remaining

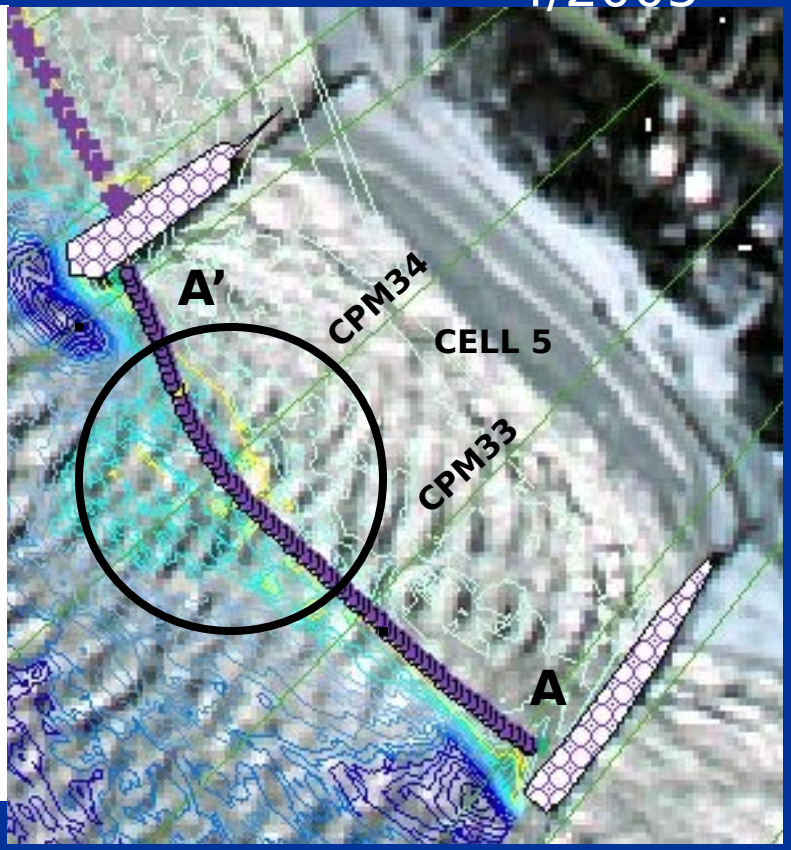
4 months later

STRUCTURAL PERFORMANCE – Structural Stability

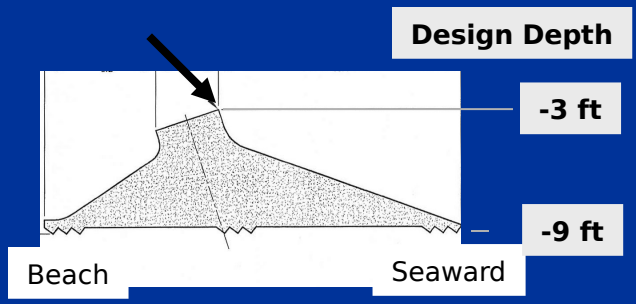
BEACHSAVER REEF - SETTLEMENT

10/2002 to 4/2005





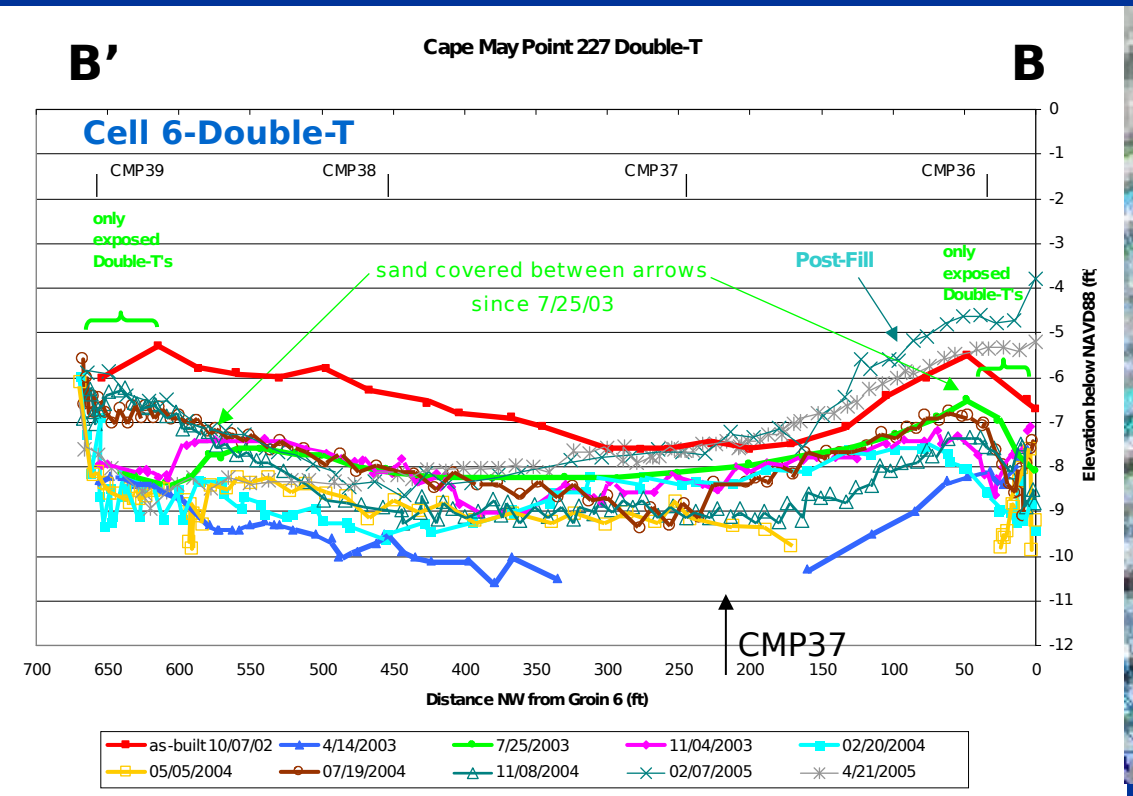
Area of most Settlement
up to 4 ft (1.2 m) within 6 months

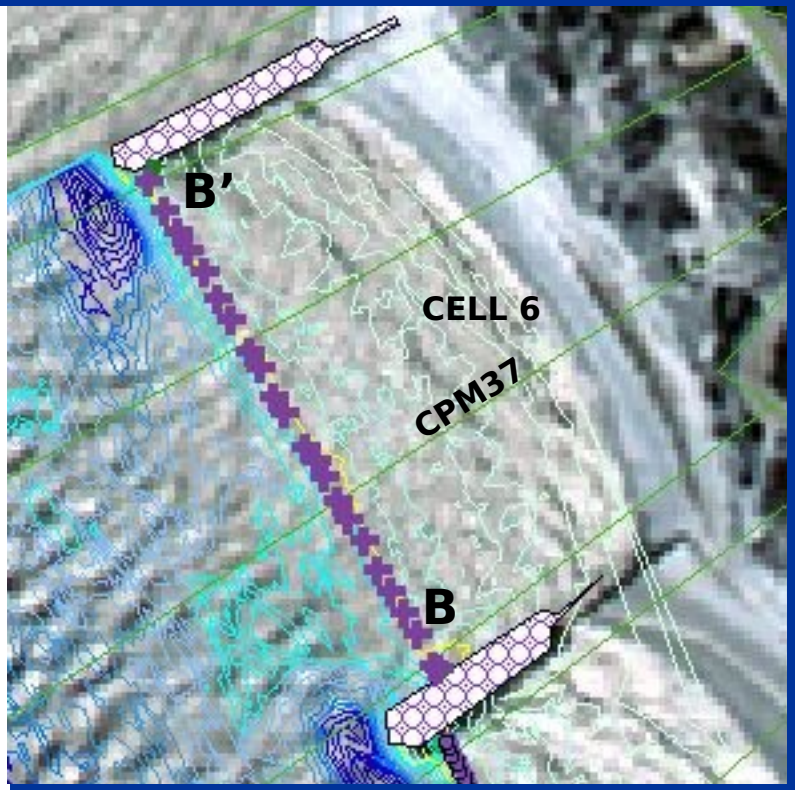


STRUCTURAL PERFORMANCE -

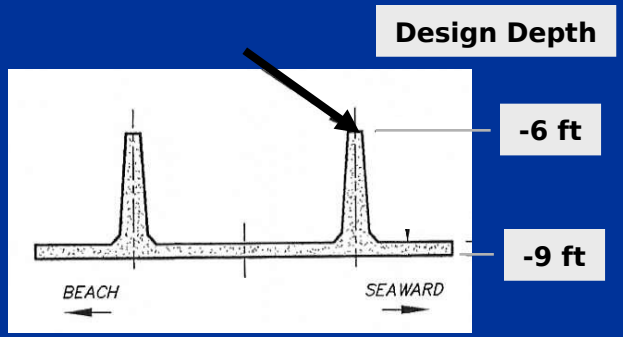
DOUBLE T SILL - SETTLEMENT

10/2002 to 4/2005



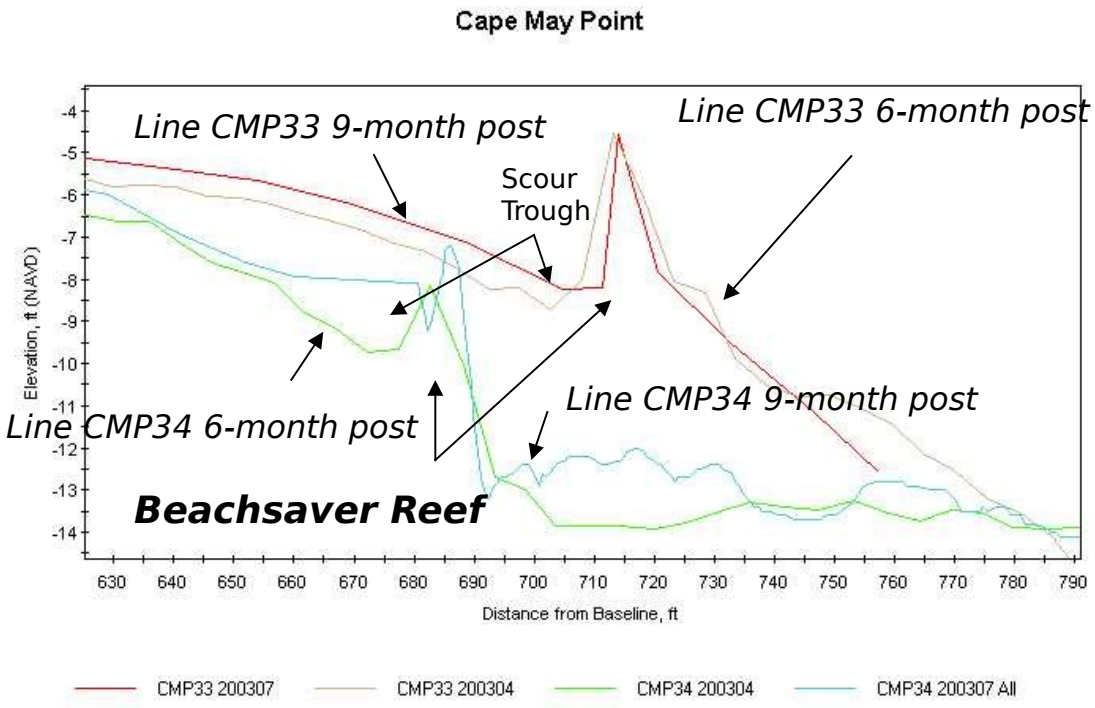


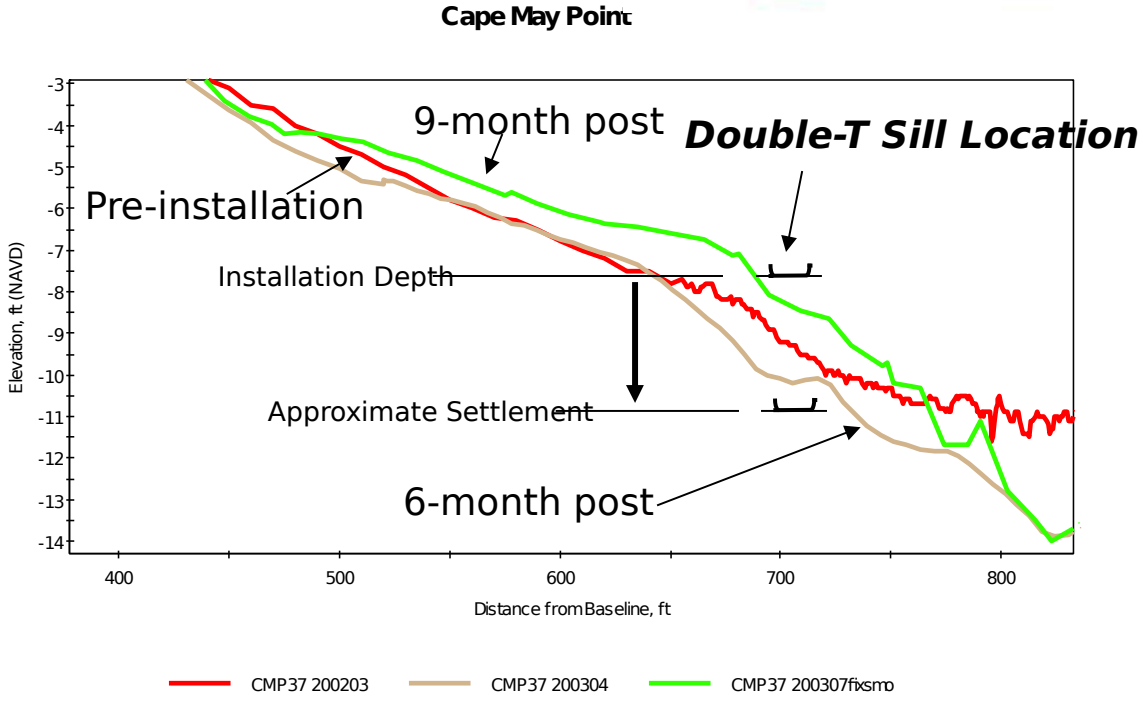
2 to 3 ft (0.5 to 1 m) Settlement &
Complete Burial under 1 to 2 ft (0.3 to 0.6 m)
of sand within 6 months



CHANGE IN STRUCTURE
Crest Elevation, Alongshore Integrity & Depth of Scour

Beachsaver Reef





Double-T Sill

SUMMARY

SECTION 227

227 Project constructed August - October 2002
2.5 Year Quarterly Monitoring Results Reported H
Eco System Restoration Project const. - Decembe

Preliminary Findings:

- **Retention of sand greatest in groin compartments w/ Beachsaver Reefs even w/ settlement**
- **Double-T Sill vs. Beachsaver Reef could not be evaluated due to settlement of Double-T Sill**
- **Anticipated savings in retention of beach fill w/ Beachsaver Reefs**

Cape May Point, NJ Demonstration Site